

What is claimed is:

1. A method for authenticating a message recipient, said method comprising the steps of:
  - a) generating a password P;
  - b) sending said password P to said message recipient over a first, secure channel;
  - c) generating a first random number as a first initialization vector IV1;
  - d) generating  $H(IV1 \parallel P)$  as an authentication key AK;
  - e) generating an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm;
  - f) generating a second random number as a second initialization vector IV2;
  - g) sending said vectors IV1 and IV2 to said message recipient over a second channel;
  - h) receiving a third random number as a third initialization vector IV3 and an authentication response AR from said recipient;
  - i) generating an authentication response key ARK as  $H(IV2 \parallel IV3 \parallel AS)$ ;
  - j) generating a decryption  $D(AR, ARK)$ , where D is a symmetric decryption algorithm corresponding to E; and
  - k) authenticating said message recipient only if  $D(AR, ARK) = ACNST2$ , where ACNST2 is a second predetermined constant.

2. A method as described in claim 1 where:

- a) steps a through f are carried out by a sender;

b) said sender sends said vector IV1 to said message recipient through a server, said server sending said vector IV1 together with said vector IV2 to said message recipient; and

c) said server receives said vector IV3 and said response AR from said recipient, and carries out steps i through k to authenticate said recipient.

3. A method as described in claim 1 where H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

4. A method as described in claim 3 where said encryption algorithm is expressed in less than 1000 bytes of code; whereby software comprising said algorithm can be quickly downloaded to a user's system.

5. A method as described in claim 4 where said encryption algorithm is an RC4 algorithm.

6. A method for sending an encrypted message, said method comprising the steps of:

- a) generating a random number as an initialization vector IV4;
- b) generating a private key PK as  $H(IV4 \parallel P)$ , where P is a password known to a message recipient;
- c) generating an encryption  $ENC = E(M \parallel H(M), PK)$ , where E is a predetermined symmetric key encryption algorithm; and
- d) sending (IV4, ENC) to said message recipient.

7. A method as described in claim 6 comprising the further step of receiving authentication of said message recipient prior to sending (IV4, ENC).

8. A method as described in claim 7 where said message recipient is authenticated by the steps of:

- a) generating a password P;
- b) sending said password P to said message recipient over a first, secure channel;
- c) generating a first random number as a first initialization vector IV1;
- d) generating  $H(IV1 \parallel P)$  as an authentication key AK;
- e) generating an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm;
- f) generating a second random number as a second initialization vector IV2;
- g) sending said vectors IV1 and IV2 to said message recipient over a second channel;
- h) receiving a third random number as a third initialization vector IV3 and an authentication response AR from said recipient over said second channel;
- i) generating an authentication response key ARK as  $H(IV2 \parallel IV3 \parallel AS)$ ;
- j) generating a decryption  $D(AR, ARK)$ , where D is a symmetric decryption algorithm corresponding to E; and
- k) authenticating said message recipient only if  $D(AR, ARK) = ACNST2$ , where ACNST2 is a second predetermined constant.

9. A method as described in claim 8 where:

- a) steps a through f are carried out by a sender;
- b) said sender sends said vectors IV1 and IV2 to said message recipient through a server; and

c) said server receives said vector IV3 and said response AR from said recipient, and carries out steps i through k to authenticate said recipient.

10. A method as described in claim 6 where H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

11. A method as described in claim 10 where said encryption algorithm is expressed in less than 1000 bytes of code; whereby software comprising said algorithm can be quickly downloaded to a user's system.

12. A method as described in claim 11 where said encryption algorithm is an RC4 algorithm.

13. A method for responding to an authentication challenge, said method comprising the steps of:

- a) receiving initialization vectors IV1 and IV2;
  - b) generating an authentication response key as  $H(IV1 \mid P)$ , where P is a password received from a sender;
  - c) generating an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm;
  - d) generating a third random number as a third initialization vector IV3;
  - e) generating an authentication response key ARK as  $H(IV2 \mid IV3 \mid AS)$ ;
  - f) generating an authentication response AR as  $E(ACNST2, ARK)$ ;
- and
- g) sending (IV3, AR) to said sender.

14. A method as described in claim 13 where:

- a) steps a through f are carried out by a message recipient;
- b) said message recipient sends said vector IV3 and said response AR to a server; and
- c) said server receives said vector IV3 and said response AR from said recipient, and authenticates said recipient.

15. A method as described in claim 13 where H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

16. A method as described in claim 15 where said encryption algorithm is expressed in less than 1000 bytes of code; whereby software comprising said algorithm can be quickly downloaded to a user's system.

17. A method as described in claim 16 where said encryption algorithm is an RC4 algorithm.

18. A method for receiving an encrypted message, said method comprising the steps of:

- a) receiving (IV4, ENC), where  $ENC = E(M \parallel H(M), PK)$ , M is said message, and E is a predetermined encryption algorithm;
- b) generating PK as  $H(IV4 \parallel P)$ , where P is a password received from a sender of said message over a secure channel;
- c) generating  $D(ENC, PK) = (M \parallel H(M))$ , where D is a symmetric key decryption algorithm corresponding to E;
- d) calculating H(M) from said value of M generated in step c; and
- e) accepting said generated value of M only if said calculated value of H(M) equals said value of H(M) generated in step c.

19. A method as described in claim 18 where H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

20. A method as described in claim 19 where said encryption algorithm is expressed in less than 1000 bytes of code; whereby software comprising said algorithm can be quickly downloaded to a user's system.

21. A method as described in claim 16 where said encryption algorithm is an RC4 algorithm.

22. A method as described in claim 18 where said initialization vector IV4 and said encryption ENC are received from said sender through a server.

23. A method for secure communication of a message to a message recipient, said method comprising the steps of:

a) sending message data encrypted with a symmetric key algorithm, a private key for said encryption algorithm being generated by hashing first data, said first data including a password; where

b) said first data is hashed with an encryption algorithm defined hash algorithm using said encryption algorithm.

24. A method as described in claim 23 further comprising the steps of:

a) authenticating a message recipient by the exchange of second data encrypted with said encryption algorithm, an authentication key for said encryption algorithm being generated by hashing third data, said third data including a password; where

b) said third data is hashed with an encryption algorithm defined hash algorithm using said encryption algorithm.

25. A method as described in claim 24 where said encryption algorithm is expressed in less than 1000 bytes of code; whereby software comprising said algorithm can be quickly downloaded to a user's system.

26. A method as described in claim 24 where said encryption algorithm is an RC4 algorithm.

27. A sender data processing system for use in a system for authenticating a message recipient, said sender data processing system being programmed to:

- a) generate a password P;
- b) send said password P to said message recipient over a first, secure channel;
- c) generate a first random number as a first initialization vector IV1;
- d) generating  $H(IV1 \parallel P)$  as an authentication key AK;
- e) generate an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm; and
- f) send said vector IV1 to said message recipient over a second channel; where
- g) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

28. A server data processing system for use in a system for authenticating a message recipient, said server data processing system being programmed to:

- a) receive an authentication string AS and a first initialization vector IV1 from a sender;

- b) generate a second random number as a second initialization vector IV2;
- c) send said vectors IV1 and IV2 to a message recipient;
- d) receive a third random number as a third initialization vector IV3 and an authentication response AR from said recipient over said second channel;
- e) make a predetermined selection of an authentication response key ARK as  $H(IV2 \parallel IV3 \parallel AS)$ ;
- f) generate a decryption  $D(AR, ARK)$ , where D is a symmetric decryption algorithm corresponding to E; and
- g) authenticating said message recipient only if  $D(AR, ARK) = ACNST2$ , where ACNST2 is a second predetermined constant; where
- h) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

29. A message recipient data processing system for use in a system for authenticating a message recipient, said message recipient data processing system being programmed to:

- a) receive initialization vectors IV1 and IV2;
- b) generating an authentication key AK as  $H(IV1 \parallel P)$ , where P is a password received from a sender;
- c) generating an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm;
- d) generate a third random number as a third initialization vector IV3;
- e) generating an authentication response key ARK as  $H(IV2 \parallel IV3 \parallel AS)$ ;



- f) generate an authentication response AR as  $E(\text{ACNST2}, \text{ARK})$ ;
- and
- g) send (IV3, AR) to said sender; where
- h) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

30. A sender data processing system for use in a system for secure communication of a message to a message recipient, said sender data processing system being programmed to:

- a) generate a random number as an initialization vector IV4;
- b) generate a private key PK as  $H(\text{IV4} \mid \text{P})$ , where P is a password known to a message recipient;
- c) generate an encryption  $\text{ENC} = E(\text{M} \mid H(\text{M}), \text{PK})$ , where E is a predetermined symmetric key encryption algorithm; and
- d) send (IV4, ENC) to said message recipient; where
- e) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

31. A message recipient data processing system for use in a system for secure communication of a message to a message recipient, said message recipient data processing system being programmed to:

- a) receive (IV4, ENC), where  $\text{ENC} = E(\text{M} \mid H(\text{M}), \text{PK})$ , M is said message, and E is a predetermined encryption algorithm;
- b) generating PK as  $H(\text{IV4} \mid \text{P})$ , where P is a password received from a sender of said message over a secure channel;
- c) generate  $D(\text{ENC}, \text{PK}) = (\text{M} \mid H(\text{M}))$ , where D is a symmetric key decryption algorithm corresponding to E;
- d) calculate H(M) from said value of M generated in step c; and

e) accept said generated value of M only if said calculated value of  $H(M)$  equals said value of  $H(M)$  generated in step c; where

f) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

32. A computer-readable medium carrying one or more sequences of one or more instructions for controlling a sender data processing system to:

a) generate a password P;

b) send said password P to said message recipient over a first, secure channel;

c) generate a first random number as a first initialization vector IV1;

d) generating  $H(IV1 \parallel P)$  as an authentication key AK;

e) generate an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm; and

f) send said vector IV1 to said message recipient over a second channel; where

g) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

33. A computer-readable medium carrying one or more sequences of one or more instructions for controlling a server data processing system to:

a) receive an authentication string AS and a first initialization vector IV1 from a sender;

b) generate a second random number as a second initialization vector IV2;

c) send said vectors IV1 and IV2 to a message recipient;

d) receive a third random number as a third initialization vector IV3 and an authentication response AR from said recipient over said second channel;

e) make a predetermined selection of an authentication response key ARK as  $H(IV2 \mid IV3 \mid AS)$ ;

f) generate a decryption  $D(AR, ARK)$ , where D is a symmetric decryption algorithm corresponding to E; and

g) authenticating said message recipient only if  $D(AR, ARK) = ACNST2$ , where ACNST2 is a second predetermined constant; where

h) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

34. A computer-readable medium carrying one or more sequences of one or more instructions for controlling a message recipient data processing system to:

a) receive initialization vectors IV1 and IV2;

b) generate an authentication key AR as

$H(IV1 \mid P)$ , where P is a password received from a sender;

c) generate an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm;

d) generate a third random number as a third initialization vector IV3;

e) make a predetermined selection of an authentication response key ARK as  $H(IV2 \mid IV3 \mid AS)$ ;

f) generate an authentication response AR as  $E(ACNST2, ARK)$ ;

and

g) send (IV3, AR) to said sender; where

h) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

35. A computer-readable medium carrying one or more sequences of one or more instructions for controlling a sender data processing system to:

- a) generate a random number as an initialization vector IV4;
- b) generate a private key PK as  $H(IV4 \parallel P)$ , where P is a password known to a message recipient;
- c) generate an encryption  $ENC = E(M \parallel H(M), PK)$ , where E is a predetermined symmetric key encryption algorithm; and
- d) send (IV4, ENC) to said message recipient; where
- e) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.

36. A computer-readable medium carrying one or more sequences of one or more instructions for controlling a message recipient data processing system to:

- a) receive initialization vectors IV1 and IV2;
  - b) generate an authentication key AR as  $H(IV1 \parallel P)$ , where P is a password received from a sender;
  - c) generate an authentication string AS as  $E(ACNST1, AK)$ , where ACNST1 is a predetermined constant and E is a predetermined symmetric key encryption algorithm;
  - d) generate a third random number as a third initialization vector IV3;
  - e) make a predetermined selection of an authentication response key ARK as  $H(IV2 \parallel IV3 \parallel AS)$ ;
  - f) generate an authentication response AR as  $E(ACNST2, ARK)$ ;
- and

- g) send (IV3, AR) to said sender; where
- h) H is an encryption algorithm defined hash algorithm using said encryption algorithm E.